

WHAT IS CLAIMED IS:

1. A surface acoustic wave filter comprising series-arm resonators and parallel-arm resonators
5 that are connected in a ladder-like fashion,
the surface acoustic wave filter satisfying conditions expressed as:

$$1 \times 10^6 \leq 4\pi^2 f_0^2 R^2 C_{op} C_{os} \leq 3.1 \times 10^6$$

10 where C_{op} is an electrostatic capacitance of the parallel-arm resonators, C_{os} is an electrostatic capacitance of the series-arm resonators, f_0 is a center frequency, and R is a nominal impedance.

15 2. A surface acoustic wave filter comprising series-arm resonators and parallel-arm resonators that are connected in a ladder-like fashion,
the surface acoustic wave filter satisfying
20 conditions expressed as:

$$1.3 \times 10^6 \leq 4\pi^2 f_0^2 R^2 C_{op} C_{os} \leq 3.1 \times 10^6$$

25 where C_{op} is an electrostatic capacitance of the parallel-arm resonators, C_{os} is an electrostatic capacitance of the series-arm resonators, f_0 is a center frequency, and R is a nominal impedance.

30 3. A surface acoustic wave filter comprising series-arm resonators and parallel-arm resonators that are connected in a ladder-like fashion,
the surface acoustic wave filter satisfying
conditions expressed as:

$$1.6 \times 10^6 \leq 4\pi^2 f_0^2 R^2 C_{op} C_{os} \leq 2.9 \times 10^6$$

where C_{op} is an electrostatic capacitance of the

parallel-arm resonators, C_{os} is an electrostatic capacitance of the series-arm resonators, f_0 is a center frequency, and R is a nominal impedance.

5 4. The surface acoustic wave filter as claimed in claim 1, wherein the ratio C_{op}/C_{os} of the electrostatic capacitance C_{op} to the electrostatic capacitance C_{os} is 0.5.

10 5. The surface acoustic wave filter as claimed in claim 1, wherein at least comb-like electrodes in the series-arm resonators and the parallel-arm resonators are covered with a dielectric film.

15 6. The surface acoustic wave filter as claimed in claim 1, wherein the center frequency f_0 is in the 5 GHz band.

20 7. The surface acoustic wave filter as claimed in claim 1, wherein the series-arm resonators and the parallel-arm resonators are connected to form a four-stage structure.

25 8. A filter device comprising:
 a surface acoustic wave filter; and
 a package to which the surface acoustic wave filter is mounted by a wire bonding technique,
 the surface acoustic wave filter including series-arm resonators and parallel-arm resonators that
30 are connected in a ladder-like fashion,
 the surface acoustic wave filter satisfying conditions expressed as:

$$1 \times 10^6 \leq 4\pi^2 f_0^2 R^2 C_{op} C_{os} \leq 3.1 \times 10^6$$

35 where C_{op} is an electrostatic capacitance of the parallel-arm resonators, C_{os} is an electrostatic

capacitance of the series-arm resonators, f_0 is a center frequency, and R is a nominal impedance, the package having a signal terminal connected to signal electrodes of the surface acoustic wave filter with one bonding wire, and the bonding wire having an inductance L_i that satisfies conditions expressed as:

$$0.7 \leq L_i \leq 1.3.$$

10 9. A filter device comprising:
a surface acoustic wave filter: and
a package to which the surface acoustic wave filter is mounted by a wire bonding technique,
15 the surface acoustic wave filter including series-arm resonators and parallel-arm resonators that are connected in a ladder-like fashion,
the surface acoustic wave filter satisfying conditions expressed as:

20
$$1.3 \times 10^6 \leq 4\pi^2 f_0^2 R^2 C_{op} C_{os} \leq 3.1 \times 10^6$$

where C_{op} is an electrostatic capacitance of the parallel-arm resonators, C_{os} is an electrostatic capacitance of the series-arm resonators, f_0 is a center frequency, and R is a nominal impedance, the package having a signal terminal connected to signal electrodes of the surface acoustic wave filter with one bonding wire, and the bonding wire having an inductance L_i that satisfies conditions expressed as:

$$0.7 \leq L_i \leq 1.3.$$

35 10. A filter device comprising:
a surface acoustic wave filter: and
a package to which the surface acoustic wave

filter is mounted by a wire bonding technique,
the surface acoustic wave filter including
series-arm resonators and parallel-arm resonators that
are connected in a ladder-like fashion,

5 the surface acoustic wave filter satisfying
conditions expressed as:

$$1.6 \times 10^6 \leq 4\pi^2 f_0^2 R^2 C_{op} C_{os} \leq 2.9 \times 10^6$$

10 where C_{op} is an electrostatic capacitance of the
parallel-arm resonators, C_{os} is an electrostatic
capacitance of the series-arm resonators, f_0 is a
center frequency, and R is a nominal impedance,

15 the package having a signal terminal connected to
signal electrodes of the surface acoustic wave filter
with one bonding wire, and

the bonding wire having an inductance L_i that
satisfies conditions expressed as:

20 $0.7 \leq L_i \leq 1.3$.

11. A filter device comprising:

a surface acoustic wave filter: and

25 a package to which the surface acoustic wave
filter is flip-chip mounted,

the surface acoustic wave filter including
series-arm resonators and parallel-arm resonators that
are connected in a ladder-like fashion,

30 the surface acoustic wave filter satisfying
conditions expressed as:

$$1 \times 10^6 \leq 4\pi^2 f_0^2 R^2 C_{op} C_{os} \leq 3.1 \times 10^6$$

35 where C_{op} is an electrostatic capacitance of the
parallel-arm resonators, C_{os} is an electrostatic
capacitance of the series-arm resonators, f_0 is a
center frequency, and R is a nominal impedance,

the package having a signal line formed by a microstrip line, and

the microstrip line having an inductance L_1 that satisfies conditions expressed as:

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$$0.7 \leq \text{Li} \leq 1.3.$$

12. A filter device comprising:

a surface acoustic wave filter: and

10 a package to which the surface acoustic wave
filter is flip-chip mounted,

the surface acoustic wave filter including series-arm resonators and parallel-arm resonators that are connected in a ladder-like fashion,

15 the surface acoustic wave filter satisfying
conditions expressed as:

$$1.3 \times 10^6 \leq 4\pi^2 f_0^2 R^2 C_{op} C_{os} \leq 3.1 \times 10^6$$

20 where C_{op} is an electrostatic capacitance of the parallel-arm resonators, C_{os} is an electrostatic capacitance of the series-arm resonators, f_0 is a center frequency, and R is a nominal impedance,

the package having a signal line formed by a
25 microstrip line, and

the microstrip line having an inductance L_1 that satisfies conditions expressed as:

$$0.7 \leq Li \leq 1.3.$$

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13. A filter device comprising:

a surface acoustic wave filter; and

a package to which the surface acoustic wave filter is flip-chip mounted,

35 the surface acoustic wave filter including series-arm resonators and parallel-arm resonators that are connected in a ladder-like fashion.

the surface acoustic wave filter satisfying conditions expressed as:

$$1.6 \times 10^6 \leq 4\pi^2 f_0^2 R^2 C_{op} C_{os} \leq 2.9 \times 10^6$$

5

where C_{op} is an electrostatic capacitance of the parallel-arm resonators, C_{os} is an electrostatic capacitance of the series-arm resonators, f_0 is a center frequency, and R is a nominal impedance,

10 the package having a signal line formed by a microstrip line, and

the microstrip line having an inductance L_i that satisfies the conditions expressed as:

15 $0.7 \leq L_i \leq 1.3$.

14. The filter device as claimed in claim 8, wherein the ratio C_{op}/C_{os} of the electrostatic capacitance C_{op} to the electrostatic capacitance C_{os} is 20 0.5.

15. The filter device as claimed in claim 8, wherein at least comb-like electrodes in the series-resonators and the parallel-resonators are covered with 25 a dielectric film.

16. The filter device as claimed in claim 8, wherein the center frequency f_0 is in the 5 GHz band.

30 17. The filter device as claimed in claim 8, wherein the series-arm resonators and the parallel-arm resonators are connected to form a four-stage structure.

18. The filter device as claimed in claim 8, 35 wherein the package is made of ceramics.